case, provide a rugged system for service use, including consideration of fatigue, jamming, ground gusts, control inertia, and friction loads. In the absence of a rational analysis, the design loads resulting from 0.60 of the specified limit pilot forces are acceptable minimum design loads; and

(4) If operational loads may be exceeded through jamming, ground gusts, control inertia, or friction, the system must withstand the limit pilot forces specified in § 29.397, without yielding.

[Doc. No. 5084, 29 FR 16150, Dec. 3, 1964, as amended by Amdt. 29–26, 55 FR 8002, Mar. 6, 1990]

§ 29.397 Limit pilot forces and torques.

(a) Except as provided in paragraph (b) of this section, the limit pilot forces are as follows:

(1) For foot controls, 130 pounds.

(2) For stick controls, 100 pounds fore and aft, and 67 pounds laterally.

(b) For flap, tab, stabilizer, rotor brake, and landing gear operating controls, the following apply (R=radius in inches):

(1) Crank wheel, and lever controls, [1 + R]/3 × 50 pounds, but not less than 50 pounds nor more than 100 pounds for hand operated controls or 130 pounds for foot operated controls, applied at any angle within 20 degrees of the plane of motion of the control.

(2) Twist controls, 80R inch-pounds.

[Amdt. 29–12, 41 FR 55471, Dec. 20, 1976, as amended by Amdt. 29–47, 66 FR 23538, May 9, 2001]

§ 29.399 Dual control system.

Each dual primary flight control system must be able to withstand the loads that result when pilot forces not less than 0.75 times those obtained under § 29.395 are applied—

(a) In opposition; and

(b) In the same direction.

§ 29.411 Ground clearance: tail rotor guard.

(a) It must be impossible for the tail rotor to contact the landing surface during a normal landing.

(b) If a tail rotor guard is required to show compliance with paragraph (a) of this section—

(1) Suitable design loads must be established for the guard: and

(2) The guard and its supporting structure must be designed to withstand those loads.

§ 29.427 Unsymmetrical loads.

(a) Horizontal tail surfaces and their supporting structure must be designed for unsymmetrical loads arising from yawing and rotor wake effects in combination with the prescribed flight conditions.

(b) To meet the design criteria of paragraph (a) of this section, in the absence of more rational data, both of the following must be met:

(1) One hundred percent of the maximum loading from the symmetrical flight conditions acts on the surface on one side of the plane of symmetry, and no loading acts on the other side.

(2) Fifty percent of the maximum loading from the symmetrical flight conditions acts on the surface on each side of the plane of symmetry, in opposite directions.

(c) For empennage arrangements where the horizontal tail surfaces are supported by the vertical tail surfaces, the vertical tail surfaces and supporting structure must be designed for the combined vertical and horizontal surface loads resulting from each prescribed flight condition, considered separately. The flight conditions must be selected so that the maximum design loads are obtained on each surface. In the absence of more rational data, the unsymmetrical horizontal tail surface loading distributions described in this section must be assumed.

[Amdt. 27–26, 55 FR 8002, Mar. 6, 1990, as amended by Amdt. 29–31, 55 FR 38966, Sept. 21, 1990]

GROUND LOADS

§ 29.471 General.

(a) *Loads and equilibrium.* For limit ground loads—

(1) The limit ground loads obtained in the landing conditions in this part must be considered to be external loads that would occur in the rotorcraft structure if it were acting as a rigid body; and

(2) In each specified landing condition, the external loads must be placed in equilibrium with linear and angular